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Alignment of organizational level workload and maintenance manning in the United States Navy F/A-18C community

Allen, Mitchell R.

Monterey, California. Naval Postgraduate School

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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

Alignment of Organizational Level Workload and Maintenance Manning in the United States Navy F/A-18C Community

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By: **Mitchell R. Allen**
December 2005

Advisors: **Kenneth Doerr**
Don Eaton
Bill Hatch

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13. ABSTRACT

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Data shows that squadron workload is not constant across the deployment cycle. Historical aircraft utilization rates suggest that projected utilization rates in the F/A-18C ROC/POE are accurate for their intended purpose. This should not, however, eliminate the use of historical aircraft utilization data in the manpower process. Squadrons could be more accurately manned at sea by using a percentage of projected aircraft utilization rates.

Current alignment of workload and manning results in paying a premium for personnel deployed who do not support workload. Establishment of an operational tempo department to more accurately align workload and manning through funding of requirements is one possible solution to balancing workload and manning while supporting Navy personnel policies and initiatives.

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ALIGNMENT OF ORGANIZATIONAL LEVEL WORKLOAD AND MAINTENANCE MANNING IN THE UNITED STATES NAVY F/A-18C COMMUNITY

Mitchell R. Allen, Lieutenant, United States Navy

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

from the

NAVAL POSTGRADUATE SCHOOL
December 2005

Author: ______________________________
Mitchell R. Allen

Approved by: ______________________________
Kenneth Doerr

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Don Eaton

____
Bill Hatch

____
Robert N. Beck, Dean
Graduate School of Business and Public Policy

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I. INTRODUCTION

A. BACKGROUND

Navy Manpower Analysis Center (NAVMAC) determines aviation maintenance manpower requirements through systems analysis of historical workload, projected workload, and the application of staffing standards. Resources used by NAVMAC include, but are not limited to; historical maintenance data, scheduled maintenance data, and aircraft utilization rates. The goal of this research is to determine if current squadron manning properly reflects the weekly workload requirements of squadrons based on their operating environment when moving from shipboard to shore- based operations. That is, to determine if people are where they will be most effectively utilized in order to meet Navy readiness and personnel management goals. The following research questions were assembled to address this issue:

- Does the Navy Standard at – sea Workweek (NSW) accurately reflect work accomplished by sea – deployable squadrons?
- Is the assumption that workload is level across the deployment cycle accurate?
- If workload is not level, can a structural realignment of sea and shore manpower requirements level workload while supporting Navy programs and initiatives such as retention, Sea Warrior, and Sea Swap?

B. SCOPE AND METHODOLOGY

This research is limited to the F/A-18C community to control the scope of the project and to improve data collection accuracy. The first research question addresses workweeks and their application to squadron workload. In this area the NSW and its standard application to squadrons that operate at sea and ashore are discussed. The second question examines historical workload data. Unscheduled workload is based on historical data. Unscheduled workload for 58 deployment cycles is analyzed for changes in workload during the deployment cycle. The third question addresses historical workload but also includes a review of historical aircraft utilization rates. Here projected wartime aircraft utilization rates are compared to aircraft utilization rates required to support operations ashore. This comparison is used to determine if workload varies

between these periods. If workload does vary can alignment of sea and shore manning alleviate uneven workload while supporting Navy initiatives such as Sea Warrior and Sea Swap? Further, can the application of these initiatives support retention? The question of supporting navy initiatives through alignment of manning also requires information about how squadrons operate while in homeport and at sea. Squadron working hour data was collected through interviews of squadron personnel.

Historical NAVMAC data for fiscal years 1988 through 2004 was used in the analysis. Squadron unscheduled maintenance man hour data and deployment periods are placed into Microsoft Excel Spreadsheets. To test the data a Generalized Linear Model (GLM) will be used (Cohen, Cohen, 1993). The GLM will be used to test for differences in deployment cycle periods. A pairwise comparison (Bonferroni Test) is also conducted to compare each deployment period to all other deployment periods.

II. LITERATURE REVIEW

A. INTRODUCTION

This review examines previous studies of more accurately aligning workload and manning. U.S. Navy leaders, officers, and sailors are all becoming increasingly aware of the need to properly align manning and other assets. This review discusses the following: The terms and processes used to determine manpower requirements are reviewed and clarified; two major determinants for manpower requirements and their resulting products are described; and potential benefits of alignment actions are listed. Among these benefits are several Navy initiatives, such as Sea Swap, personnel tempo, homesteading, and retention. Also addressed are advantages of retaining corporate knowledge in the F/A-18C community. These advantages include a more knowledgeable workforce, reduced maintenance induced malfunctions, and improved readiness and logistics. Finally, due to their impact on managing personnel and workload; personal leave, sea duty, and sea – duty counters are discussed.

B. MANPOWER DETERMINANTS

Two major determinants of manpower requirements in aviation maintenance are projected aircraft utilization rates and the productive work portion of the NSW. Projected aircraft utilization is the total projected operating hours per aircraft per month in a wartime environment. The productive portion of the NSW is the time sailors are responsible for performing maintenance tasks. Aircraft utilization rates are listed in the F/A-18 Required Operational Capabilities and Projected Operating Environment (ROC/POE) Statement, which along with the NSW is defined below. The detailed process of naval aviation maintenance manpower requirements determination, and the subsequent funding and manning of requirements, is derived from a conglomerate of publications and instructions that are used in conjunction with aircraft utilization and workweek inputs to produce manpower requirements (CNO, 1998; CNAF, 2005; NAVMAC, 2000; NAVMAC, 2004; BUPERS, 2005). The main goal of these instructions is to ensure that manpower requirements are accurately determined and that manning inventories are fairly distributed to meet wartime requirements.

1. ROC/POE

The ROC/POE statement provides a list of capabilities and the operational environment in which these capabilities will be performed in wartime. The ROC portion of the ROC/POE statement lists specific capabilities that units must be capable of performing in combat. The POE portion of the statement lists the environment, such as, during aircraft carrier operations, in which ROC elements must be performed. Additionally, the POE lists the projected utilization rates of aircraft during wartime in terms of flight hours per month and average sortie length (CNO, 1998, Appendix B).

2. The Navy Standard Workweek

As a major determinant of manpower requirements the NSW has had its relevance questioned. Total Force Programming Manpower and Information Management (N12) asked Center for Naval Analyses (CNA) to assess the NSW "in response to the critique that the manpower determination process is flawed" (Moore, Griffis, Keenan, 2001, 18). In this study CNA found the average non-watch stander performed 69.5 hours of productive work per week. However, CNA found no evidence that NSW is shaped by empirical studies. CNA also states that "… until we have better evidence of what the workweek is revising the workweek based on data is risky." Also addressed by CNA was the currency of ROC/POEs stating only 26% were current.

Although there are several versions of the NSW (a total of ten for military and civilians) of primary concern to this research are the shore-based squadrons and squadron personnel at sea workweeks. The workweeks as listed in OPNAVINST 1000.16J appendix C are provided as Figures 1 and 2 on pages 5 and 6.

This research concentrates specifically on the production portions of the NSW from which aviation maintenance manpower requirements are determined (CNO, 2002, C-4/5). Shore based, non-deployable squadrons operate on a 40 hour (33.38 production hours) workweek while, squadron personnel at sea operate on an 81 hour (70 production hours) workweek. The general application of a single workweek to activities that move from ship to shore, such as aviation squadrons, can have negative impacts on morale and retention (Moore, Griffis, Keenan, 2001).

Commanding Officers are not constrained by the NSW and are allowed to manage personnel working hours to meet mission requirements (CNO, 2002, C-1). However, CNO guidance acknowledges that routine extension of working hours can have negative impacts on morale and safety and should be avoided when possible (CNO, 2002, C-1).

Potential costs of shortening the NSW are a potential roadblock to realignment of workload. A shorter workweek means more requirements. The productive workweek is a divisor in requirements determination, so the more people work, the less people you need. In contrast, less time allotted for work requires more people. The CNO extended the production portion of the Squadron Personnel at Sea Workweek from 67 hours to 70 hours in June, 2002 (CNO, 2002). Moore et al., (2002) also recognize the costs and benefits to sailors from changes to the workweek acknowledging savings for the Navy by increasing the workweek.

Standard Workweek			40.00 hrs
(Routine is 8 hours per day,			
5 days per week, excluding meal hours)			
Productive Workweek			33.38 hrs
Analysis of Duty Hours			
Total hours available weekly		40.00	
Less non-available time:			
Training	(1.47)		
Service Diversion	(1.00)		
Leave	(2.62)		
Holidays	(1.53)	(6.62)	
Total hours available for productive work		(33.38)	

Figure 1. Shore-Based Squadrons Workweek (eg., HT, VT) Where Accompanying Dependents are Authorized

Standard Workweek			81.00 hrs
(Routine is 8 hours per day,			
5 days per week, excluding meal hours)			
Productive Workweek			70.00 hrs
Analysis of Duty Hours			
Total hours available weekly		81.00	
Less non-available time:			
Training	(7.00)		
Diversion	(4.00)	(<u>11.00</u>)	
Total hours available for			
productive work		<u>70.00</u>	

Figure 2. Squadron Personnel at Sea Workweek

C. MANPOWER VS. MANNING

In order to discuss realignment of manpower, the terms manpower, manpower requirements, and manning must be defined. The term manpower is often used to reflect human resources or manning levels of naval units (House Testimony, 2004). However, the term manpower does not appear, without a modifier, in the Chief of Naval Operations (CNO) manpower requirements determination instruction (CNO, 2002, Appendix B). CNO's instruction for determining manpower requirements describes requirements as virtual place holders in the manpower process, identifying quantitative and qualitative needs of units (CNO, 2002, B-15). Manning is defined as "the specific inventory of personnel at an activity in terms of numbers, grades, and occupational groups" (CNO, 2002, B-9). NAVMAC's definition of manning is synonymous with the CNOs. As in the CNO's instruction, NAVMAC does not list the term manpower without a modifier. NAVMAC does not list the term requirement individually either, instead, NAVMAC uses the term "manpower requirements" and defines the term for Navy as:

> The numbers of military and civilian manpower required for each activity, which have been approved for planning purposes by CNO, as representing:

(1) A need for manpower by quantities and skills, determined using industrial engineering and management analysis techniques.

(2) A statement of quantity and quality of manpower needed to perform Required Operational Capabilities in a Projected Operating Environment (ROC/POE) (NAVMAC, 2000, Glossary).

The Bureau of Naval Personnel (BUPERS) refers to manning as, "…the function of determining the quality, quantity, [ratings and numbers] and priority for assignment of personnel to all billets within a composite" (MILPERSMAN 1306-100, 3). This term is more in alignment with a manpower requirement as defined by the two previous units. BUPERS' term "manning control" more accurately reflects the definition of manning as defined by CNO and NAVMAC. This research uses the terms manpower, requirements, and manning as defined by CNO and NAVMAC.

D. MANPOWER DOCUMENTS

1. Squadron Manpower Document (SQMD)

The SQMD is developed by NAVMAC and is the source document for the Activity Manpower Document (AMD). The F/A-18C SQMD is a standardized document for F/A-18C squadrons[1] listing quantitative and qualitative manpower requirements based on ROC/POE information (CNO, 1998, B-16).

2. Activity Manpower Document (AMD)

As described in the *Manual of Total Force and Manpower Policies and Procedures* (CNO, 2002, 6), "the AMD is the single authoritative source for an activity's statement of manpower requirements … allocated to perform assigned missions". The AMD list 100 percent of personnel required for maintaining squadron aircraft, as well as support personnel. Squadrons are rarely, if ever, manned at 100 percent due to constraints imposed by the manning process (BUPERS, 2002, 1306-100, 8-16). Keep in mind, however, that squadrons rarely operate at 100 percent (W.M. Kelly, Personal Communication, June 13, 2005). The AMD also identifies requirements that have been authorized (i.e., requirements to be manned). The AMD for each activity may vary

[1] There are currently two SQMDs for the F/A-18C. The differences are based on the total of aircraft assigned. There are currently 17 F/A-18C AMDs based on two SQMDs.

slightly as requirements are qualified for enlisted and officer community management goals. These variations are not relevant in the total requirements determination. An example of such a variation may be having an avionics master chief petty officer in one squadron and an airframes master chief petty officer in another. Each of these master chiefs would be filling the generic requirement for a maintenance master chief petty officer.

3. Navy Manning Plan (NMP)

The NMP is used in determining fair share allocations of enlisted personnel. That is to fairly distribute personnel assets (manning) that are in excess or shortage of manpower requirements. The NMP fairly distributes personnel by quality and quantity. (CNO, 1997, C-3) (MILPERSMAN, 2002, 1306-100, 2).

4. Enlisted Distribution Verification Report (EDVR)

The EDVR is:

> A monthly statement of an activity's enlisted personnel account. It lists all individuals assigned and provides a summary by distribution community of the present and future manning status of the activity; a common reference for communicating manning status between an activity and its manning control authority (MCA); and a statement of account for verification by the activity. (CNO, 1997, D-2)

The separation of manpower and manning occurs between the AMD and EDVR. Figure 3 on page 9 shows this separation in a linear process from ROC/POE to EDVR.

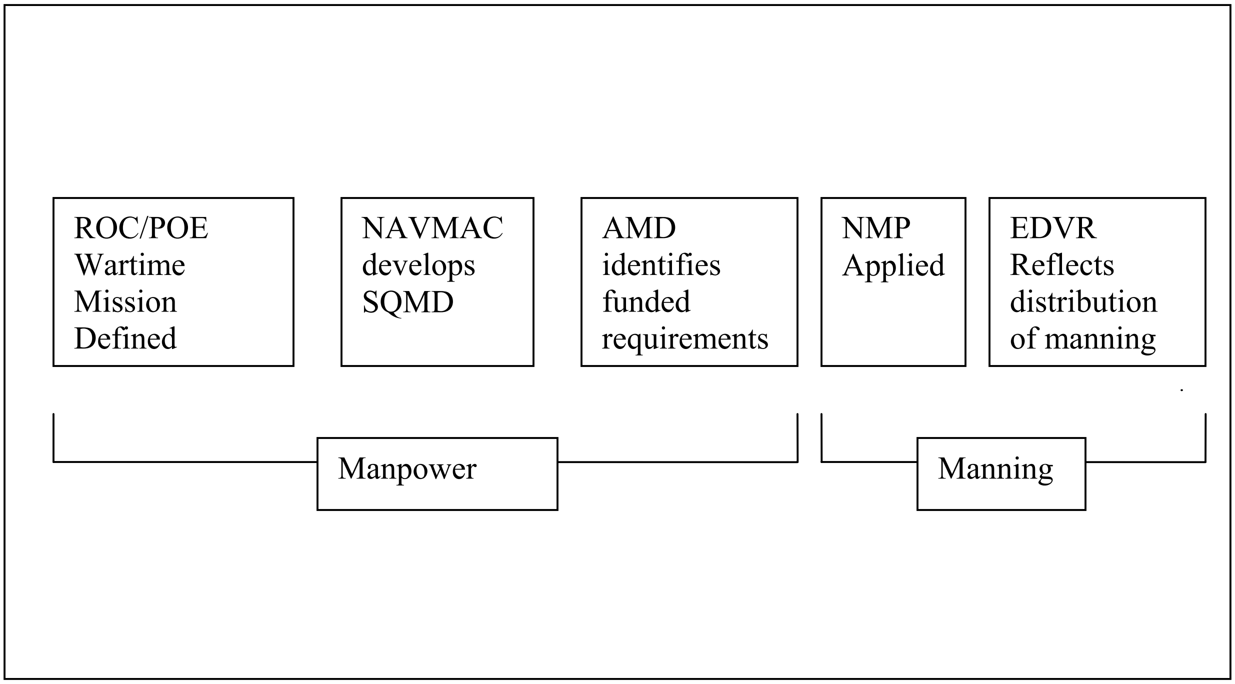

Figure 3. Manpower Documents Reflecting Manpower vs. Manning

E. AWARENESS

Accurately determining Navy manpower requirements is a key issue for the Chief of Naval Operations (CNO) (Clark, 2004, p. 2; Fein, 2005; Scutro, 2005, p. 12). Potential fallout from failure to accurately identify manpower requirements and subsequently fill those requirements can threaten long term manning goals. On the other hand, accurate determination and subsequent filling of requirements has great potential in leading to successfully meeting Navy personnel goals and polices such as personnel tempo, retention, and homesteading.

In his research on Personnel Tempo and retention rates (Cooke, CNA, 1992) states "the most robust findings are that the percentage of time underway when not deployed and very long deployments are negatively associated with first-term retention." An example of time underway when not deployed may be short periods at sea for training exercises. Golding and Griffiis extend on previous CNA studies, examining the effects of heightened alert and wartime conditions on retention since the attacks of September 11, 2001. Golding and Griffis found no evidence that increased operational tempo and

extended deployments were negatively affecting retention. They do, however, state that retention problems may occur if frequent and extended deployments become the norm (Golding, Griffisd, 2002, 14). Golfin, Gasch, and Griffis (1996) explore the impacts of homesteading / home basing on retention, performance, and correcting the geographical imbalance of sea / shore rotations.

Former CNO, Admiral Vern Clark, recognizing the far reaching effects of manning on other Navy policies, emphasized manpower issues as one of his top 5 priorities for 2005 (Clark, 2004). CNO, Admiral Michael Mullen, also acknowledges the importance of manpower and manning, listing manpower and personnel issues as one of three main challenges facing the Navy (Fein, 2005; Scutro, 2005, p12). Vice Admiral Gerald L. Hoewing, Chief of Naval Personnel (CNP) and Deputy Chief of Naval Operations Manpower and Personnel testified before the Military Personnel Subcommittee of the Senate Armed Services Committee in 2005 on FY-06 Defense Personnel Programs and stated "… the success of Navy's vision for future combat effectiveness and employment is tied to our ability to properly shape the Force -- get all Navy members with the right skills to the right place at the right time" (Senate Testimony, 2005, 5).

Members of the naval forces, at all levels, are developing and proposing methods for the redistribution of manpower and other assets to support making the Navy smaller, while still being effective in meeting mission requirements (Brennan, 1998; Culver, 2002; Fleming, 1997). Brennan suggests three options for the "United States Navy Helicopter force structure." One of these options is to realign the force along with mission under a Helicopter Air Wing Commander. Culver suggests optimal distribution of pilots and MH-60S helicopters to reduce lost flying days. Fleming discusses the cost and benefits of reduced manning with specific regard to "Smart Ship." CNP validated the need for a smaller force when testifying before the House Armed Services Committee Subcommittee on Total Force, he stated that "the Navy has, in its current inventory, more people than needed to meet mission tasking" (House Testimony, 2004).

F. ALIGNMENT

1. Sea Operational Detachments (SEAOPDETS)

Recognizing the potential for aligning workload with manning is not a new concept. SEAOPDETS were created to eliminate excess manpower requirements created from rounding. When current SEAOPDET workload was performed by individual squadron's requirements would increase from rounding. This is due to deployable squadrons being attached to carrier air wings and deploying as an aggregated unit. There are generally three F/A-18C squadrons in an air wing. If a squadron required .03 personnel for I-Level support during deployment each squadron would have to be assigned 1 requirement overstating the requirement by 2 (W.M. Kelly, Personal Correspondence, August 9, 2005). The creation of SEAOPDETS eliminated this overstatement of requirements by combing the .03 workload for each squadron into a single requirement. SEOPDETS now consist of personnel trained in aircraft intermediate level maintenance that are assigned to Aircraft Intermediate Maintenance Department (AIMD) and follow the workload from shore installations to aircraft carriers when squadrons embark (CNAF, 2005, 3-2). This philosophy has now carried over to shore establishments. AIMDs ashore are now referred to as Aircraft Intermediate Maintenance Detachments and have been realigned to fall under Type Wing Commanders (Nieto, 2005, 1). SEAOPDET personnel work a 40 (33.38 production) hour week ashore and an 81 (70 production) hour week at sea. This is possible because personnel assigned to SEAOPDETS augment the manning and workload of either the sea or shore AIMD depending on the location of the squadrons they support. SEAOPDETs manpower requirements are based on the at-sea workweek.

2 F/A-18C Utilization

An accurate understanding of alignment of personnel and workload requires a brief discussion of aircraft utilization. Aircraft utilization rates in the POE reflect projected wartime utilization. During peace operations aircraft utilization rates can be predicted from training requirements. Training and readiness requirements are delineated by Commander Naval Air Force (CNAF) in COMNAVAIRFORINST 3500.1B. In this instruction CNAF lists minimum flight hours per pilot, per month to maintain readiness

levels. Readiness levels for squadrons are reported via "M-ratings." M-ratings "reflect the level of training completed by the squadron" (CNAF, n.d., Encl 4, 6). "CNO requires squadrons to be M-2 by the beginning of their employability period" (CNAF, n.d., Encl 4, 7). The impact of M-2 in determining manpower requirements is discussed in the analysis section. To this point projected aircraft utilization and training aircraft utilization requirements have been outlined. Next, historical aircraft utilization rates and their relation to determining manpower requirements are discussed.

F/A-18C squadrons have met or exceeded monthly projected flight hours from the ROC/POE 42 times in the last 17 years (W.M. Kelly, Personal Correspondence, June 13, 2005). Each of these occurrences can be matched to a major campaign such as Desert Storm, Enduring Freedom, and Iraqi Freedom. During these campaigns squadrons exceeded POE flight hours only 7 times for two or more consecutive months (6 for two consecutive months and 1 for 3 consecutive months). In only 1 out of the 7 times that POE hours were exceeded for consecutive months did a squadron stay within the projected sortie length. In the other 6 instances exceeding POE hours can be contributed to extended sortie lengths.

The significance of the increased sortie length goes back to aircraft utilization rates. If aircraft are being flown more hours per sortie than projected, sorties are occurring at a less frequent rate and aircraft turnaround maintenance is performed less frequently. Scheduled maintenance, however, occurs more frequently. Interestingly, maintenance man hour per flight hour ratios during these brief periods decreased instead of increased. This is the result of the extended sortie length during combat operations (Chandler, 2002). This effect on maintenance man hour per flight hour is due to non-abort discrepancies, for example, if a light bulb burns out at the beginning of a sortie the sortie is still completed but the number of flight hours flown in relation to hours worked is greater than if aircraft were operating at projected sortie rates.

Aircraft require maintenance based on intervals of both calendar days and flight hours (CNAF, 2005, 12-6). This requirement combined with increased utilization would tend to support increasing manning during these periods. However, aircraft that are flying cannot be worked on and for this reason increased manning does not necessarily

solve the problem. A possible solution is to rotate aircraft to increase flight hours, which was recommend for the H-46 (Culver, 2002).

G. SUPPORTING NAVY INITIATIVES

The U.S. Navy continues to research initiatives that will allow the service to meet their primary mission while simultaneously retaining the personnel needed to operate an all volunteer force (Cooke et al., 1992; Golding, 2004; Golfin et al., 1996; Moore, 2001). Of these initiatives those that are related to this research are: Sea Warrior, Sea Swap, homesteading, maintaining personal tempo of operations (PERSTEMPO), and retention. Properly aligning manning with workload can affect each of these initiatives.

1. Sea Warrior

Sea Warrior is the vision of having the right people in the right place at the right time. This work looks into whether the right place and the right time is at sea.

2. Sea Swap

Sea Swap allows ships to remain deployed on station longer by limiting transit time, to and from operational areas. Swapping crews at 6 month intervals allows the Navy to keep ships on station longer without violating PERSTEMPO (Senate Testimony, 2002). Sea Swap has been considered successful by some (Dickson, 2004), and a failure by others (Schonauer, 2004). Regardless of these evaluations of effectiveness, Sea Swap supports the trend of moving personnel to the work. In the case of Sea Swap, the work is aboard ship.

3. Homesteading

Homesteading has been researched since 1996. Possible benefits of homesteading are increased retention and reduced permanent change of station cost. An identified problem with homesteading is a mismatch of sea and shore billets (Quester et al., 1996, 39). Quester, et al., (1996, 39) noted that the establishment of shore billets will reduce the need to incorporate other recommendations from the study such as increasing sea billets.

4. Personnel Tempo

Guidance for PERSTEMPO is outlined in OPNAVINST 3000.13B. This instruction sets guidance on PERSTEMPO to ensure continual monitoring of this quality of life issue. Specifically, "the program and its goals are the culmination of a deliberate process to balance support of national objectives with reasonable operating conditions for our naval personnel, and maintain the professionalism associated with going to sea while providing a reasonable home life" (CNO, 2000, 1).

5. Retention

Time away while not deployed and PERSTEMPO are primary reasons listed by sailors for separation (Cooke, 1992). Reluctance to relocate due to personnel reasons is another reason sailors list for separation (Quester et al., 1996). By identifying when and where sailors are most needed the Navy may be able to eliminate variances in working hours and duty assignments from sailor's lives.

H. F/A-18C COMMUNITY ADVANTAGES

Possible advantages of aligning workload and manning which may be gained by the F/A-18C community include: retaining corporate knowledge, reducing training cost through reduction of learning, and increased readiness through the retention of quality personnel and reduction of maintenance induced errors. These advantages are either directly or indirectly related to the benefits of supporting Navy initiatives as described above.

1. Retaining Corporate Knowledge and Reducing Training Cost

As Brooking (1999, p34) observes: "Human centered assets comprise the collective expertise, creative and problem solving capability, leadership, entrepreneurial and managerial skills embodied by the employees of the organization." The effects of personnel turnover are not limited to one or two individuals but can affect the entire organization. March (1999, p124) states: "Since there is a positive relation between length of service in the organization and individual knowledge, the greater the turnover, the shorter the average length of service and the lower the average individual knowledge at any point." Retaining corporate memory requires retaining individuals.

Retaining corporate knowledge can also reduce training costs. To highlight this point the cost to get an Avionics Electronics Technician to their first squadron is estimated to be $60,987.60 ($14,206.00 Recruiting, $11,461.60 Basic Training, $ 4,698.00 Avionics Class "A" School, $30,622.00 F/A-18C Training at CNATTU).[2] Each time a sailor separates (regardless of rank or rate) the recruiting and Basic Training cost must be paid for their replacement.

2. Increased Readiness

Increased readiness is in part a byproduct of retaining corporate knowledge. By retaining corporate knowledge maintenance errors are reduced, system problems are analyzed faster, and scheduled maintenance can, potentially, be performed more efficiently. The end result is improved aircraft readiness (i.e., more full mission capable aircraft on the flight line).

I. PERSONAL LEAVE, SEA PAY, AND SEA - DUTY COUNTERS

A thorough analysis of the at-sea workweek requires a brief look into the policies of leave, sea pay, and sea - duty counters. These policies introduce increased work, increased management of personnel, and conflict between types of sea duty.

1. Personal Leave

Personal leave time is not considered in the at-sea NSW. The shore workweek allows 2.62 hours of leave per person per week. Assuming a squadron is manned at 100% of requirements and each of the 131 maintenance personnel in a 10 plane F/A-18C squadron takes their earned 30 days leave, 3,930 workdays must be performed by personnel not on leave. This point is highlighted when personnel preparing for or returning from deployment are required to work long hours to support pre and post - cruise leave periods. The Navy does make considerations for personnel that are not allowed to take leave. BUPERS (2002, Article 1050-070) states that personnel may accrue up to 90 days leave under specified circumstances. The accrual of such large

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[2] Recruiting and Basic Training cost obtained from www.dod.mil/comptroller/par/fy2004/06-01_detailed _performance.pdf Retrieved Oct 3, 2005. Avionics Class "A" School cost obtained from Naval Aviation Technical Training Center (NATTC) Pensacola (Anderson, R.L. Personal Correspondence, Oct 4, 2005). Center for Naval Aviation Technical Training Unit (CNATTU) cost obtained from (Martin, M.J. (Personal Correspondence, Oct 4, 2005).

amounts of leave results in two problems. First, allowing a member to take accrued leave in excess of their 30 days earned strains personnel management. Second, accruing this leave is contradictory to MILPERSMAN 1050-30 which outlines the benefits of an aggressive leave program. This article further identifies (subparagraph 10b) "Circumstances for Special Emphasis to Grant Leave." In this section protracted periods of deployment is listed as a circumstance to be considered.

2. Sea Duty

Personnel on sea duty receive sea pay as compensation for the recognized hardships of long working hours endured during sea-duty assignments (Golding and McArver, 2001). Squadron personnel receive sea pay while onboard ship but do not receive sea pay while at their home stations. Assuming that sea pay is for being on sea duty and not necessarily for being onboard ship should squadron personnel receive sea pay for their entire "sea-duty assignment?" Simple application of the NSW would imply that the answer to this question is yes. The true question, however, is; are squadron personnel actually working sea duty hours ashore? If so, is there a way to manage the workload imposed on individual sailors to make the workweek applicable by squadron location (ashore or afloat)?

3. Sea Counters

Squadron personnel sea counters do not run while ashore. Again, assuming sea duty is sea duty and the NSW is applied to both shipboard and squadron personnel, why do some sea counters run while others are stopped? Although this subject is beyond the scope of this research allowing sea counters to run for squadron personnel may be a small way of increasing morale and making sea duty more attractive.

III. DETERMINING MANPOWER REQUIREMENTS

A. POLICY

CNO defines manpower requirement determination as "Total Force Manpower Requirements Determination. Total force includes peacetime and wartime, active and reserve military, civilians, and contractors" (CNO, 2002). The CNO further states "Aviation Manpower requirements shall be based on directed mission, functions, and tasks (MFTs) and/or required operational capability/projected operational environment (ROC/POE) and reflected on the Activity Manpower Document (AMD). Workload shall be determined using industrial engineering or other justifiable techniques, which yield accurate manpower requirements" (CNO, 2002).

B. THE PROCESS

1. Maintenance Manpower Requirements Determination

The following paragraphs briefly describe the aviation maintenance manpower requirements process. These paragraphs are provided to give the reader a general understanding of the process. The actual process is more involved and requires detailed analysis to accurately determine manpower requirements.[3]

The aviation manpower requirements process is a bottom up process. It begins with the calculation of maintenance production work centers' requirements. Then, overhead requirements are calculated. The last step is to determine support personnel requirements.

All maintenance production work centers' requirements are determined by summing the man-hours forecasted for corrective maintenance (CM), preventive maintenance (PM), support action maintenance (SA), facilities maintenance (FM), utility tasking (UT), and administrative support (AS). This sum is divided by the productive workweek. The resulting answer (whole number and decimal fraction) is converted to a requirement through the application of a rounding rule.

[3] The requirements process description was compiled from *Corrective Maintenance Report F/A-18C*, Kelly, 2005.

CM consists of work accomplished on an unscheduled basis, plus work accomplished during the fix phase of a preventative maintenance scheduled inspection, plus work accomplished as a result of an event (e.g. hard landing, round of ammunition fire, etc.) plus Technical Directive compliance. The Naval Aviation Logistics Data Analysis (NALDA) compiles maintenance data. NALDA distributes a summary of appropriate data for each type/model/series (T/M/S) of aircraft. From this data a T/M/S data set is constructed. Regression analysis is applied to T/M/S data set to develop a T/M/S predictor equation.

The other component of corrective maintenance is the T/M/S Technical Directive (TD). The Naval Air System Command (NAVAIRSYSCOM) issues a TD to modify or accomplish a one-time inspection of naval aircraft and associated equipment. Because TDs are Bureau (i.e., aircraft identification) Number specific, a T/M/S TD man-hour per aircraft factor is developed by dividing the average monthly TD coded man-hours by the average monthly number of aircraft.

Preventive maintenance consists of the preparatory time, plus the travel time to and from the aircraft, plus the time to accomplish the scheduled maintenance plus the time for clean up. NAVMAC uses the times provided by NAVAIRSYSCOM and aircraft manufacturers for scheduled maintenance requirement cards (MRC). Scheduled maintenance includes maintenance that is driven by flight hour or calendar days. For example, each aircraft must be washed every 14 days (Calendar Inspection). Gearboxes are checked by examining magnetic chip detectors every 30 flight hours (Flight Hour Driven Inspection). The times on MRCs are broken down by inspection time and rating requirements. A sample MRC is provided, see Figure 4.

CARD 1	A1-F18AE-MRC-200 Date 1 April 1995	CHANGE NO. 12	DAILY	ELEC PWR OFF
WORK AREA/ZONE	CRSN	TIME 0.3	RTG. NO. PC 1	MOS. NO. 6017 1
				HYD PWR OFF
				COND AIR NA

SUPPORT EQUIPMENT REQUIRED

Gage Assembly, Air Pressure — MIL-G-8348, Class B, Size 2

CONSUMABLES/REPLACEMENT PARTS

Cloth, Cleaning — CCC-C-46 TY1CL4
Fluid, Hydraulic — MIL-PRF-83282

WARNING: To prevent death or serious injury, make sure armament switches are OFF/SAFE/NORMAL and ordnance safety devices are installed.

1. Make sure area is free of foreign objects and the following safety items are installed/removed or correctly positioned as applicable:

Wheel Chocks
Static Groundwire
AN/ALE-39 or AN/ALE-47 Safety Switch in SAFE position
Canopy Jettison Safety Pin(s), F/A-18C(1)/ F/A-18D(2)
Ejection Seat(s) Safety Handle in SAFE position

Continued

Figure 4. Maintenance Requirement Card

The time requirements for tasks listed on MRCs do not include the time for traveling or gathering tools and materials required to perform the task (MIL-M-2361G (AS), 1987, 10). For this reason NAVMAC developed a Make Ready / Put Away (MR/PA) standard to account for this work. The MRPA Standard adds 17% to the scheduled maintenance time.

At one time support action times were collected using the Navy's standard action form (SAF) card for repetitive tasks such as aircraft turnaround inspections and servicing operations. When the CNO eliminated the use of SAF cards NAVMAC developed a set of support action standards for forecasting this work. The application of the appropriation support action standard yields the forecasted time.

Facilities maintenance consists of routine housekeeping of assigned working and operating spaces. A NAVMAC standard quantifies the time for facilities maintenance for shore based deployable and carrier deployable squadrons.

Utility tasking is time expended performing miscellaneous work which does not apply to other categories, but which is essential to the operation of a squadron. Utility

tasking is accomplished by working parties that augment ship's personnel. A NAVMAC standard quantifies the time for utility tasking.

Administrative support comprises work actions associated with the preparation and execution of plans required for the internal functioning of the command and management of assigned personnel. Administrative support includes tasks such as supervision, attending meetings, giving and receiving training, obtaining office supplies. A NAVMAC standard quantifies the time for administrative support.

Application of the POE number of aircraft, utilization rate, and sortie length to T/M/S predictor equation, T/M/S TD man-hour per aircraft factor, times on MRCs and standards yields the production work center's manpower. Currently the 10 plane F/A-18C SQMD has 131 production work center requirements. It is important to note here that this answer is only the production portion of squadron requirements and does not take into consideration overhead and support personnel.

2. Overhead and Support Personnel

Total squadron manpower requirements include overhead and support requirements in addition to production (i.e., workload driven) requirements. Examples of directed requirements include; Command Master Chief (CNO, Dec 2000, Encl 1, 2) and Safety Petty Officer (CNO, 2001, Encl 1, 20). Other personnel such as Yeomen and Personnelmen are determined by staffing standards. Staffing standards are based on the amount of work done by these ratings and is collected by NAVMAC analyst (NAVMAC, 2000).

Also included in support personnel category are integrated services. These personnel support production, directed, and population driven requirements. Integrated services personnel perform duties such as, laundryman, food service attendants, disbursing clerks, and supply personnel among others. These personnel "integrate" with departments onboard an aircraft carrier to supplement the ships food, laundry, and other services.

Other overhead and support roles include quality assurance (QA) personnel, the maintenance control division, and maintenance administration. QA personnel perform

safe for flight inspections, monitor command programs such as hydraulic contamination and tool control as well as, develop and administer test for personnel in production work centers performing QA functions. Maintenance Control personnel supervise and coordinate maintenance, ensure aircraft are safe for flight, and coordinate the maintenance actions of production work centers in support of flight requirements. Of the current 214 enlisted requirements for a10 plane F/A-18 squadron, 83 are overhead and support personnel (NAVMAC, 2004).

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IV. ALIGNMENT OF MANNING

A. HYPOTHESIS

Based on 11 years of close observation while assigned to three F/A-18 squadrons and a tour of duty at NAVMAC, it is my observation that squadron workload varies while squadron fair share manning is constant. This observation suggests that squadron manning and workload are frequently not aligned just before and after deployment (see Figure 5, page 24). The misalignment between workload and manning is a result of the building up and tearing down of aircraft, required just before and after deployment, to ensure squadrons deploy with their full allotment of aircraft.

To determine if others shared the view of fluctuating workload, interviews were conducted among squadron and wing personnel at Naval Air Station Lemoore, Ca. Personnel interviewed included the type wing maintenance officer, type wing maintenance master chief petty officer, squadron commanding officers, maintenance officers, and maintenance master chief petty officers. During interviews 7 out of 12 personnel interviewed said that it was necessary to build aircraft prior to deployment with 5 of those 7 stating this resulted in increased working hours. Only 3 of 12 stated it was necessary to tear down aircraft after deployment. There was, however, concern about the increasing number of aircraft transfers and the impact that transfer and acceptance inspections are having on unscheduled workload. This concern was expressed by Commanding Officer of VFA-147 whose squadron experienced 24 aircraft transfers during the last deployment cycle. The Commanding Officer of VFA-25 also mentioned the increasing number of aircraft transfers. The type wing maintenance master chief highlighted the fact that workload generally increases prior to deployment due to required maintenance. Compass swings, electronic counter measure system sweeps, and landing gear strut servicing were provided examples.

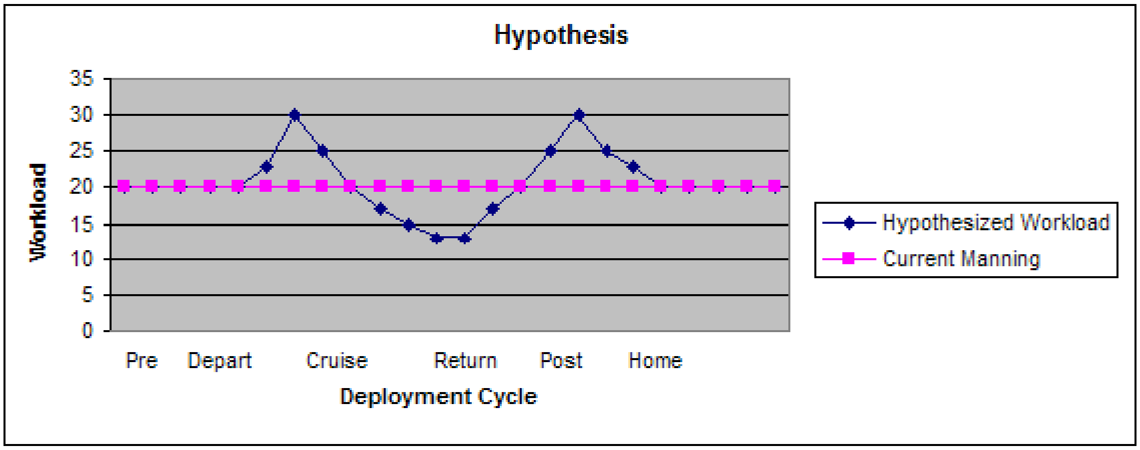

Figure 5. Manning vs. Workload

B. ANALYSIS

1. Workload, Deployment Cycles, and Flight Hours

To determine if the NSW is accurately applied to sea-deployable squadrons the workload experienced by squadrons must first be determined. In order to answer this question it was first necessary to analyze data based on the second research question. Is the assumption that workload is level across the deployment cycle accurate? To determine if workload is constant across deployment cycles 17 years of historical flight and workload data for F/A-18C squadrons was reviewed. This historical data was then aligned with deployment cycles. The specific points in the deployment cycles that were analyzed were defined as: pre deployment (2 months prior to deployment month), departure month, cruise months, return month, post deployment (2 months following return), and home months. Utilizing online resources to gather deployment information 58 deployment dates for 12 different squadrons were found. These squadrons and deployment cycles represent the sample data used in the evaluation of unscheduled workload during the evaluated periods. Table 1 (page 25) lists the squadrons and cruise periods used.

Table 1. Squadrons and Cruise Periods used in Research

VFA	From	To	From	To	From	To	From	To	From	To	From	To
15	Mar-93	Sep-93	Mar-95	Sep-95	Mar-99	Sep-99	Apr-01	Nov-01	Jan-03	Jun-03		
25	Jan-90	Dec-90	Feb-94	Aug-94	May-96	Nov-96	Jun-98	Dec-98	Aug-00	Feb-01	Jul-02	May-03
37	Oct-92	Apr-93	Oct-94	Apr-95	Nov-96	May-97	Nov-00	Apr-01	Dec-02	May-03		
82	Aug-93	Feb-94	Aug-95	Feb-96	Sep-01	Mar-02						
86	Aug-93	Feb-94	Aug-95	Feb-96	Sep-01	Mar-02						
87	Mar-93	Sep-93	Mar-95	Sep-95	Mar-99	Sep-99	Jan-03	Jun-03				
105	Oct-92	Apr-93	Oct-94	Apr-95	Nov-96	May-97	Nov-98	May-99	Nov-00	Apr-01	Dec-02	May-03
113	Jun-90	Dec-90	Feb-94	Aug-94	May-96	Nov-96	Aug-00	Feb-01				
131	May-94	Nov-94	Apr-96	Oct-96	Feb-98	Dec-98	Feb-00	Aug-00	Feb-02	Aug-02	Jan-04	Jul-04
136	May-94	Nov-94	Apr-96	Oct-96	Feb-98	Dec-98	Feb-00	Aug-00	Feb-02	Aug-02	Jan-04	Jul-04
146	Mar-91	Sep-91	Dec-95	Jun-96	Sep-97	Mar-98	Jan-00	Jun-00	Nov-01	May-02		
147	Mar-91	Sep-91	Feb-93	Aug-93	Nov-95	May-96	Sep-97	Mar-98	Jan-03	Sep-03		

As previously discussed unscheduled maintenance man hour per flight hour data is a key element of the manpower requirements determination process. Unscheduled maintenance is the element in NAVMAC's data that is reported by squadrons and used in the SQMD process (Kelly, 2005). That is, scheduled maintenance can be predicted by using times on MRCs and deriving the occurrence of scheduled maintenance based on projected utilization. Unscheduled maintenance is not so easily predicted and is based on historical data reported by squadrons. Unscheduled man hour per flight hour data was averaged over deployment cycles and then each month (labeled pre, post, etc.) was divided by the average to normalize the deployment cycle data by squadron and individual deployments. After each deployment cycle was normalized the selected periods were averaged and these resulting averages reflect the changes in workload experienced across the deployment cycle. This process was repeated for selected squadrons and then aggregated to reflect community results. Raw data is displayed in Figures 6 and 7 on page 26.

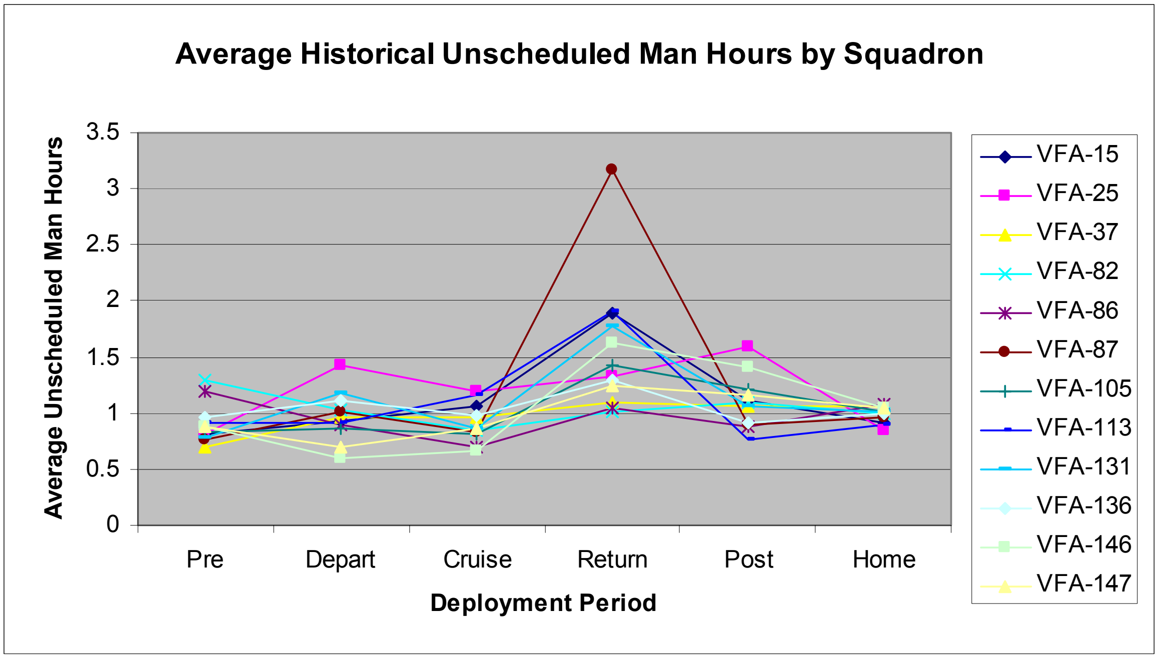

Figure 6. Average Raw Historical Unscheduled Man Hours Squadron

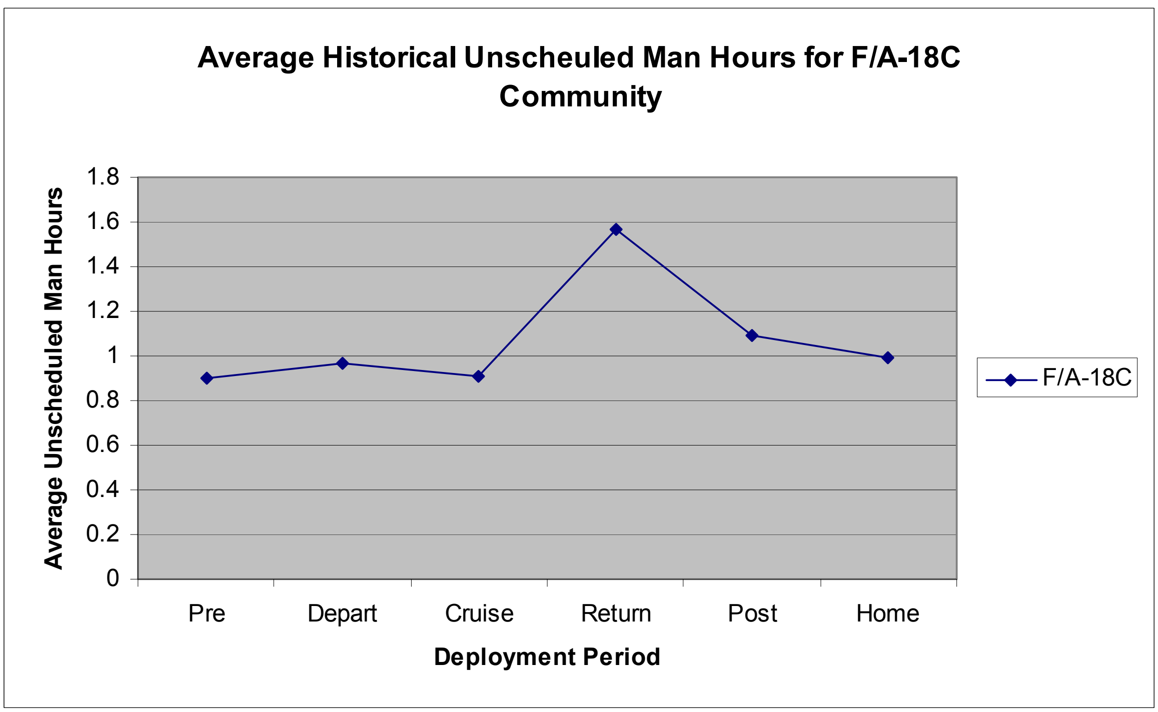

Figure 7. Average Raw Historical Unscheduled Man Hours Community

When reviewing historical data it was noted that entire months (in some cases, consecutive months) of data were represented by zeros; those months were eliminated

from the initial averaging process. There were also very high months of man hour per flight hour data. This posed a problem in skewing the data in the periods where the high hours occurred. To correct for skewing the standard deviation of unscheduled man hours per flight hour by evaluated period was taken. Periods where man hours were three standard deviations higher than the mean were eliminated from the data set. This eliminated only 17 months from the 58 deployment cycles evaluated, other periods not available as shown in Table 2 is due to information not being available. After periods with no data or high data (more than three standard deviations above the mean) were removed the remaining periods proved statistically sound for analysis. Assuming a 24 month deployment cycle and a six month deployment, the number of available observations is compared to possible observations for each period in the cycle. Table 2 shows these results. The results of squadron and F/A-18C community unscheduled workload after smoothing are presented in Figures 8 and 9 on page 28.

Table 2. Data Set Observations Available vs. Observations Possible

Deployment Cycle Period	Observations Captured	Observations Possible	Percentage of Possible Observations Captured
Pre	102	116	88%
Depart	47	58	81%
Cruise	258	348	74%
Return	45	58	78%
Post	100	116	86%
Home	579	696	83%

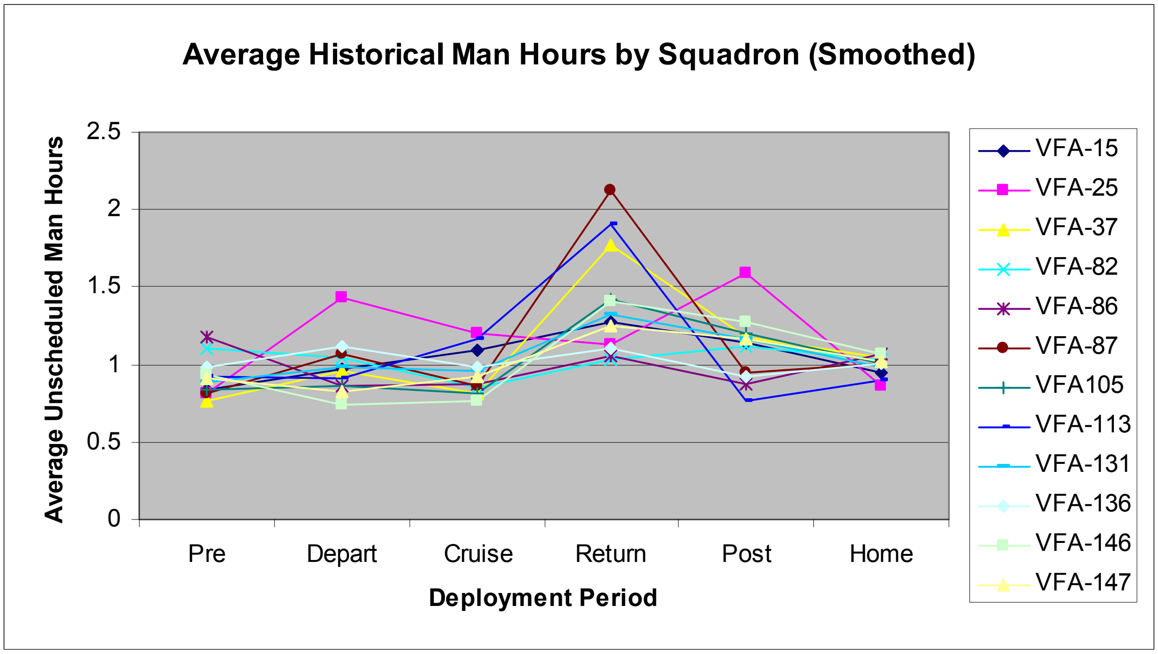

Figure 8. Average Historical Man Hours by Squadron (Smoothed)

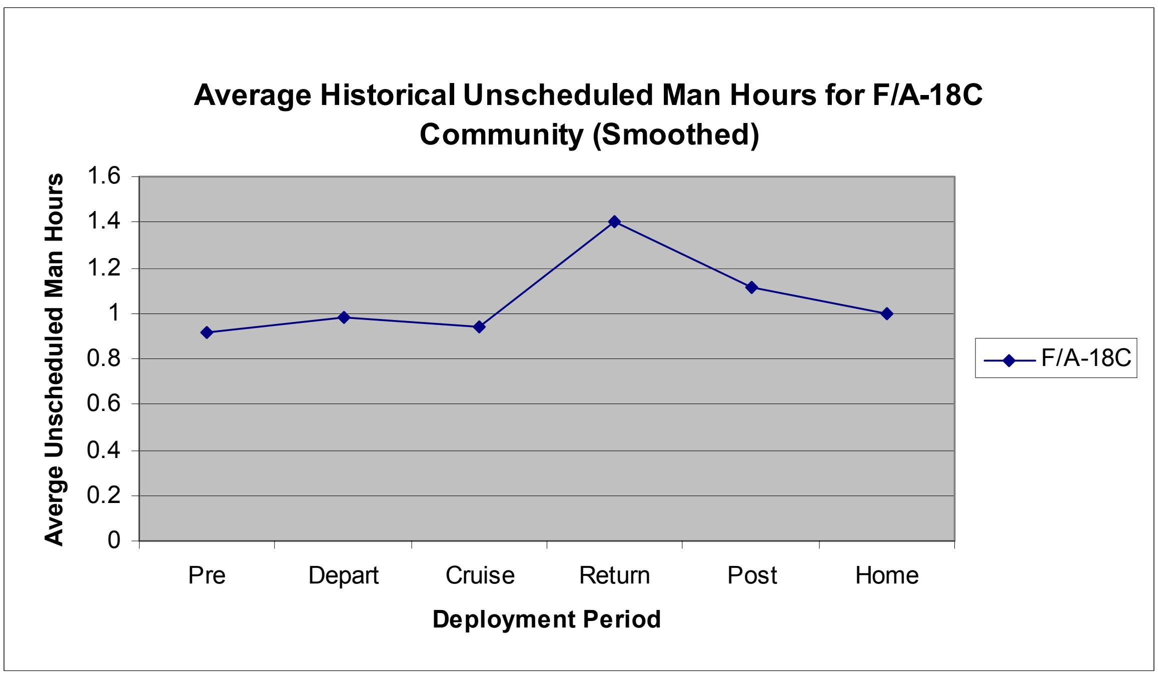

Figure 9. Average Historical Man Hours for F/A-18C Community (Smoothed)

Flight hour data was reviewed to gain a historical perspective about aircraft utilization. As a key input into the manpower requirements determination process historical, rather than projected, aircraft utilization rates may provide more accurate indications of when and where maintenance manning is most needed. Average aircraft

utilization was determined by taking reported monthly aircraft utilization rates of squadrons and averaging the rates by fiscal year. The fiscal year averages were then averaged for the 17 year period, the average monthly utilization across all periods is 33.19. Average monthly aircraft utilization rates for fiscal years 1988 through 2004 are shown in Figure 10.

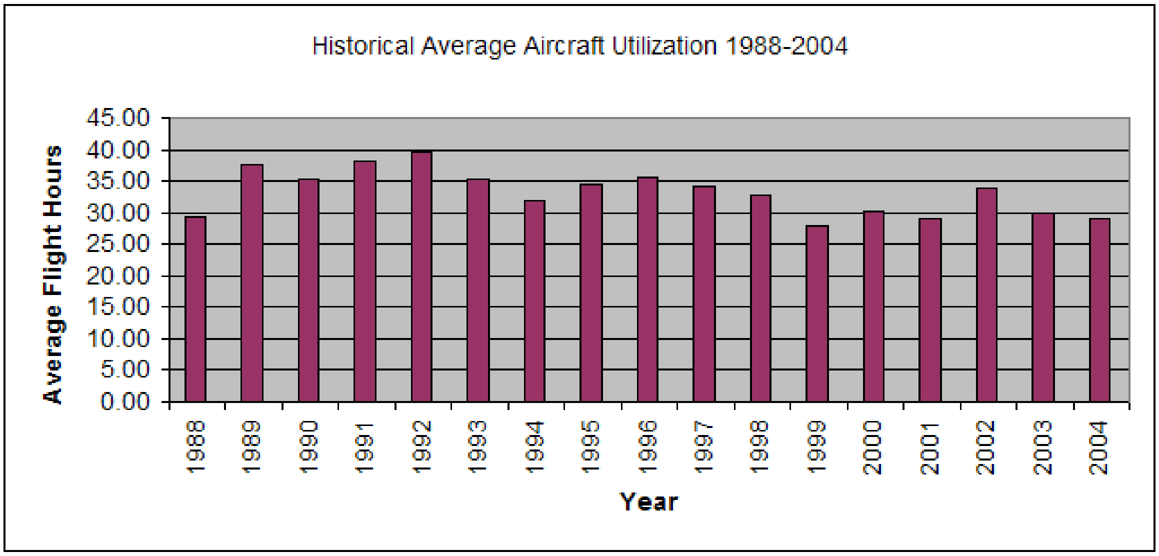

Figure 10. Historical Aircraft Utilization 1988-2004

Two periods were selected for further evaluation of the at sea and ashore aircraft utilization rates. These periods are FY 1995 – 1996 and FY 2001- 2003. The average at sea utilization for both periods is 41.4, while the average at home utilization is 31.4 and 26.2 respectively (Kelly, Personal Correspondence, June 13, 2005). The purpose of the above chart and the two additional periods evaluated is to show that aircraft utilization is relatively constant and can be predicted using historical data eliminating the need for, or at minimum improving, utilization projections.

2. Training Requirements and Aircraft Utilization Ashore

CNAF Instruction 3500.1B, enclosure 5 lists the minimum number of flight hours and sorties (based on a one and one half hour sortie length) that each pilot in a squadron must fly to maintain directed readiness levels. By multiplying the number of pilots in a squadron by the required flight hours in CNAF instruction, and then dividing by the total

number of aircraft assigned, required utilization rates ashore can be determined. Table 3 lists flight hour requirements, utilization rates, and maintenance personnel requirements (for shore duty workweek) to support M-2 and M-1 training utilization rates ashore. M-2 was chosen as the level of readiness to maintain because this is the level delineated by CNO for squadron employment. M-1 requirements are listed for comparison. Maintenance personnel required to support M-2 and M-1 readiness levels were derived at NAVMAC based on required aircraft utilization. M-1 numbers reflect concerns expressed by Commander Tom Crain, NAVMAC's Aviation Requirements Department Head and also by squadron personnel. The concern of maintaining ordnance load team integrity in the avionics and ordnance work centers was addressed by holding the number of personnel in these work centers constant for sea and shore duty workweeks.

Table 3. Training Readiness Levels and Maintenance Personnel Requirements

Readiness Level	Flight Hours Required Per Pilot	Required Utilization	Required Maintenance Personnel	Current Maintenance Personnel
M-2	18.9	30.2	143	131
M-1	23.0	36.8	144*	131

*This number reflects adjustments made in the Avionics, Ordnance, and Line work centers. Requirements in the Avionics and Ordnance are held constant to maintain load and release check team integrity. Line work center is held constant at one plane captain per shift per aircraft.

3. Manning at 80 Percent of POE Hours

Historical data shows that squadrons do not consistently operate at 100 percent of projected aircraft utilization rates. Based on this information during the NAVMAC visit it was requested that NAVMAC determine maintenance manpower requirements based on 80 percent of projected aircraft utilization.

To operate at sea, at 80 percent of current POE hours an F/A-18C squadron requires 128 maintenance personnel, a reduction of 3 personnel from present requirements (see Table 4, page 31). M-2 levels are taken from CNAFINST 3500.1B and 80 percent ROC/POE requirements were obtained from NAVMAC.

Table 4. M-2 vs. 80 Percent ROC/POE Manpower Requirements

Readiness Level	Flight Hours Per Pilot	Required Utilization	Required Maintenance Personnel	Current Maintenance Personnel
M-2	18.9	30.2	143	131
80 Percent POE	*	*	128**	131

* Aircraft utilization data from the POE is classified. ** Indicates number of requirements holding Avionics, Ordnance, and Line work centers constant.

4. Aircraft Maintenance and Squadron Working Hours

Interviews with squadron personnel at Naval Air Station, Lemoore indicate that the management of aircraft and spare parts has improved greatly and the build up and tear down of aircraft prior to and after deployment does not create a significant increase in workload. The fluctuations observed in workload data may be due to aging aircraft. Despite improvements in the wing's management of assets aircraft are approaching life limits for carrier operations, which, according to squadron and wing personnel, is resulting in an increasing number of aircraft transfer and acceptance inspections. Increased inspections are necessary to get non-life limited aircraft to squadrons going to sea, while keeping those aircraft approaching life limits ashore.

Personal interviews also revealed that squadrons are not consistently working sea – duty hours while ashore. At times squadrons are required to work weekends and extra hours preparing for and after returning from deployments. Squadrons ashore are working on average 9 hour days, 5 days per week.[4] Add to this time the fact that shipboard services are not available and the shore – duty workweek of 40 total hours is easily exceeded. Several squadrons require their corrosion control personnel to work weekends. It is environmental reasons and not workload that makes this weekend work necessary.

5. Data Set Testing and Results

A GLM was used to test for differences in unscheduled hours between deployment periods controlling for squadrons, and across years. The overall model

[4] Average working hours determined through interviews of squadron personnel in VFA-25, VFA-113, VFA-146, and VFA-147.

shows a significant fit (F = 23.176, P<.000, R^{2} = .126), and differences between periods were significant as well (F = 4.011, P<.001, R^{2} = .018). This may be due to a small number of squadron's unscheduled maintenance hours having a different pattern than others.

A Bonferroni test was conducted for pairwise comparison between deployment periods. Results of this test show significant differences between the return period and the pre, cruise, and home periods. No significant differences are noted between the return period and the departure and post periods. These results provide additional support for the need for augmentation of manning during return and post periods.

C. CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

- Navy Standard at – sea Workweek does not accurately reflect sea-deployable squadron workload

Current application of the NSW for squadron personnel at sea does not meet the criteria listed in the two workweeks previously described. Manpower requirements for squadrons that deploy are determined using the squadron personnel at – sea workweek. However, when these personnel are ashore, accompanied by their authorized dependents, and taking earned leave the shore based squadron workweek is not applied.

The NSW implies 70 hours of productive work will be performed per sailor per week while at sea and while ashore. Squadron personnel working 70 hours per week ashore without the immediate locality and support provided onboard ship experience even longer days. Transit times, food purchases, and meal preparation are just some examples of additive time experienced ashore. Although shore based operations do not always require this much work there are times when sea – deployable squadron sailors performing work ashore are required to work more than their shore based counterparts.

- Workload is not level across the deployment cycle

The data strongly supports the hypothesis that workload experienced by squadron maintenance personnel is not constant with return and post deployment workload being

dramatically higher than other periods. Moderate increases are also noticed in the pre - deployment period, refer to Figure 9. This increased workload is experienced during times when squadron personnel are taking leave in preparation for, or after returning from deployment (i.e., POM Period). The fact that fewer personnel are accomplishing this greater workload means even longer hours while ashore.

- A structural realignment of sea and shore manpower requirements could level workload while supporting Navy programs and initiatives such as retention, Sea Warrior, and Sea Swap

Studies and research discussed in the literature review suggest that structural realignment can contribute to meeting Navy goals. Allowing personnel to rotate to shore duty in the same geographical location as sea duty will eliminate one of the reasons sailors separate (Cooke, 1992). Increased retention means retaining corporate knowledge and increases the pool of talented sailors to support Sea Swap.

2. Recommendations

- Continue current application of NSW and control manning through funding of requirements

Although current application of the NSW is not perfect it appears to be accurate in meeting the intended purpose of determining wartime requirements based on projected aircraft utilization. Interviews of squadron personnel indicate that sailors are not typically working at – sea hours while ashore but do experience spikes in workload. The alleviation of increased working hours during periods of increased work is addressed below.

- Establish shore – duty billets to off set spikes in squadron workload

A practical alternative to eliminating the impact of peaks in workload on sailors is to augment squadrons at shore and at sea with qualified shore personnel when required. This concept is in general alignment with the CNO's strategy of "Sea Swap" (Senate Testimony, 2002) and would only be used at sea when necessary. This concept also supports the manpower planning system in having shore requirements support operational

forces (CNAF, 2005, 2-5). The result is more accurate alignment of manning with workload.

The number of squadron personnel being deployed should be reduced to support a percentage of projected wartime utilization. Personnel not deploying will be assigned to type wings for shore duty in an operational tempo department (OPTEMPODEPT). These shore-duty billets will be wing controlled and personnel filling these billets will be fully qualified for their rate and rank. These highly qualified personnel will be used to augment squadrons during periods of peak workload such as that experienced prior to and just after deployment. Personnel filling these billets must also be informed that the possibility of deployment exists if deployed squadrons encounter an unexpected increase in workload.

Aligning manpower requirements, manning, and workload will require no changes in the manpower requirements determination process and can be performed through the funding of requirements (i.e., billets authorized). This means continuing to determine wartime requirements based on POE hours. This is not only acceptable but desirable considering that 42 times, squadrons have been required to operate at this level. NAVMAC would continue to develop the SQMD based on POE utilization rates and AMDs would continue to list wartime requirements. However, the EDVR would reflect less billets authorized (3 less in the 80% example) in deployable squadrons, while increasing the number of shore requirements on each coast by 45. This action supports historical workload. The 45 shore requirements are the exact number required to off set the workload between the shore and at – sea workweeks during peak periods assuming three F/A-18C squadrons per air wing. The required number of shore personnel was totally linear and is not based on measured workload. Measuring the workload of the OPTEMPODEPT may result in fewer requirements.

With 15 F/A-18C squadrons[5] 45 OPTEMPODEPT requirements can be funded simply by moving the funding authorization for these billets from the squadron to the

[5] There are actually 18 F/A-18C squadrons. VFA-97 is functioning under the Unit Deployment Program and has manpower requirements that differ from the typical F/A-18C squadron. VFA-192 and VFA-195 are forward deployed and would not reap the benefits of augmentation.

OPTEMPODEPT. The remaining 45 billets would be funded on the basis of supporting Navy initiatives such as Sea Swap, Sea Warrior, and Homesteading. These billets will also help to ease the increasing imbalance between sea and shore billets. By providing shore duty for the most talented sailors the Navy has a better chance of retaining them. Shore billets will also allow sailors the opportunity to maintain their skills by working in their ratings during shore assignment. Additional savings may also be realized in reduced permanent change of station moves and training costs. An added benefit of retaining quality sailors may be realized by reducing the numbers of maintenance induced failures and increased readiness as discrepancies are repaired faster.

Determining the ranks and ratings of personnel required in the OPTEMPODEPT falls back to NAVMAC. NAVMAC would need to develop a SQMD (or shore equivalent) for this specific purpose. OPTEMPODET personnel should have support requirements fulfilled through the F/A-18C Fleet Replacement Squadron, or the host station, whichever can absorb these individuals without significant increases in support personnel requirements.

- Alignment of workload and manning might better facilitate support of recent Navy initiatives such as retention, Sea Warrior, and Sea Swap

The above recommendations discuss how the alignment of workload and manning can help support Navy initiatives. By providing shore options for our most talented sailors the Navy can support these programs and initiatives. Further, by ensuring that shore duty billets are matched with the skills of sailors rating knowledge and proficiency can be maintained. The end result is highly trained sailors choosing to stay Navy because they have been provided an alternative to extending on sea duty.

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V. RECOMMENDATIONS FOR FURTHER RESEARCH

- Would this methodology apply to other aviation communities?

All sea-deployable squadron's manpower requirements are determined using the same basic processes. If the processes are the same are potential benefits the same.

- Are peaks in squadron maintenance man hour to flight hour due to increased workload, or are increases due to aircraft availability and limited flying?

Data from this research indicates that squadron workload increases significantly during return and post – deployment months. Is this increase in maintenance man hour per flight hour due to increased work that occurs naturally after deployment or is this opportunistic work performed when aircraft are flying less? Also to be addressed. Is this workload directly related to the increased number of aircraft transfer and acceptance inspections reported by squadron personnel as necessary to keep life – limited aircraft ashore?

- Can integrated services and overhead and support personnel be aggregated and managed at the Carrier Air Wing level to reduce the numbers for these requirements?

The functions of support personnel are very generic. The maintenance of service records and generating correspondence are just two examples of areas that might be considered for integration. Some support functions already have this type of integration. Squadron Disbursing Clerks and Hospital Corpsman integrate with the ships disbursing and medical departments when squadrons embark.

- Examine the feasibility of increasing F/A-18C squadrons from 10 to 20 planes to offset overhead and support requirements?

As mentioned in this research 83 of the 214 enlisted personnel in a ten plane F/A-18C squadron are supervisory and support personnel. Combining squadrons would eliminate some of these overhead requirements. One Command Master Chief and one Safety Petty Officer instead of 2 are two examples of this type of reduction.

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